
Configuration guidelines

This section provides general rules for system configuration. The worksheets referenced in this section are provided at the end of this document.

Column configuration

Columns are numbered from 0 to 63 (the column containing CPU 0 must be Column 0). At installation, number all columns to the left of column 0 consecutively, starting with column 1. The first column to the right of column 0 is then numbered after the last column on the left of column 0. Any other columns to the right are then numbered consecutively (see [Figure 16](#)). Note that as the system expands, column numbering may become more random.

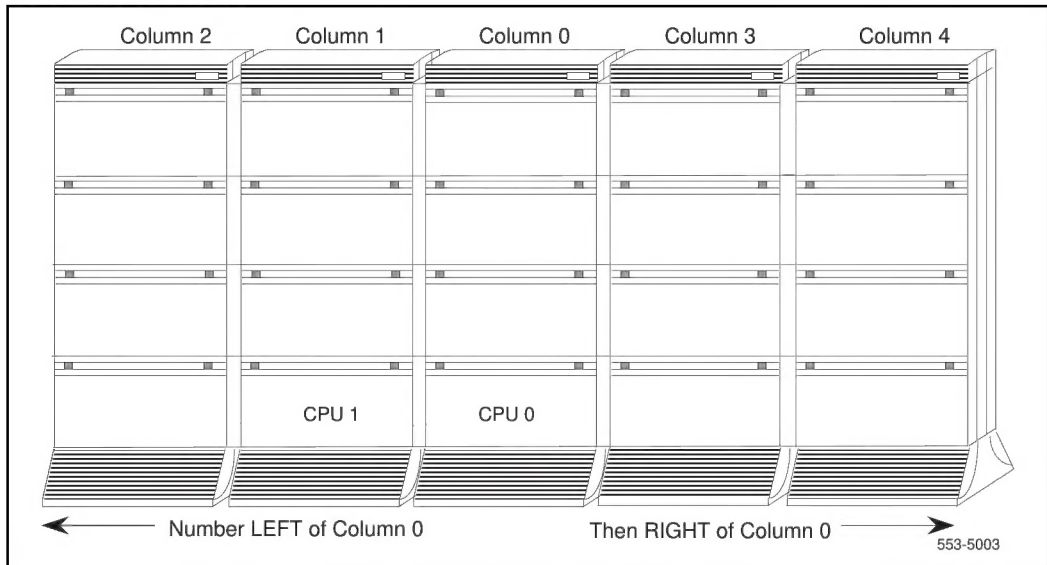
Note: Modules containing the CPU equipment should always be placed in the first two tiers of Meridian 1 system columns.

A column can contain up to four modules; however, some or all columns can be configured with fewer than four modules. The modules in each column are numbered from 0 to 3, starting from the bottom.

Cabling between network components and peripheral equipment modules (IPE or PE) can be routed externally, such as between rows, through input/output (I/O) panels or electromagnetic interference (EMI) filters.

Cabling between other types of modules, such as CPU Modules, must remain within the Meridian 1 columns. All vertically routed internal cables must be routed on the right side of the column (facing the column) to avoid possible interference from the power supplies in the modules.

Figure 16
Column numbering



The possible positioning for modules in each column is highly flexible. However, the conventions described here are generally followed when a system is initially configured, and there are a few cooling and cabling constraints.

IPE/PE Modules

The distance allowed between a network card and the peripheral equipment module it serves is limited to a maximum network cable length of 13.7 m (45 ft). A peripheral equipment module can be placed anywhere in the system, as long as it is within the range of the network cable.

Network Modules

The modules for each network group must be located together and in the same column (see [Figure 17](#)):

- The two modules that house each full network group are placed one on top of the other, with the module for shelf 0 on the bottom.

- The modules that house group 0 are located in column 0; the modules that house group 1 are located in column 1.
- Additional network groups are added to the left of the CPU columns.

InterGroup Modules

The InterGroup Module, used in options 71, 81, and 81C, is generally located at the top of its column (see [Figure 17](#)). The InterGroup Module is typically placed in Column 0, but it can be placed in Column 1 instead.

Figure 17
Option 81 with five network groups

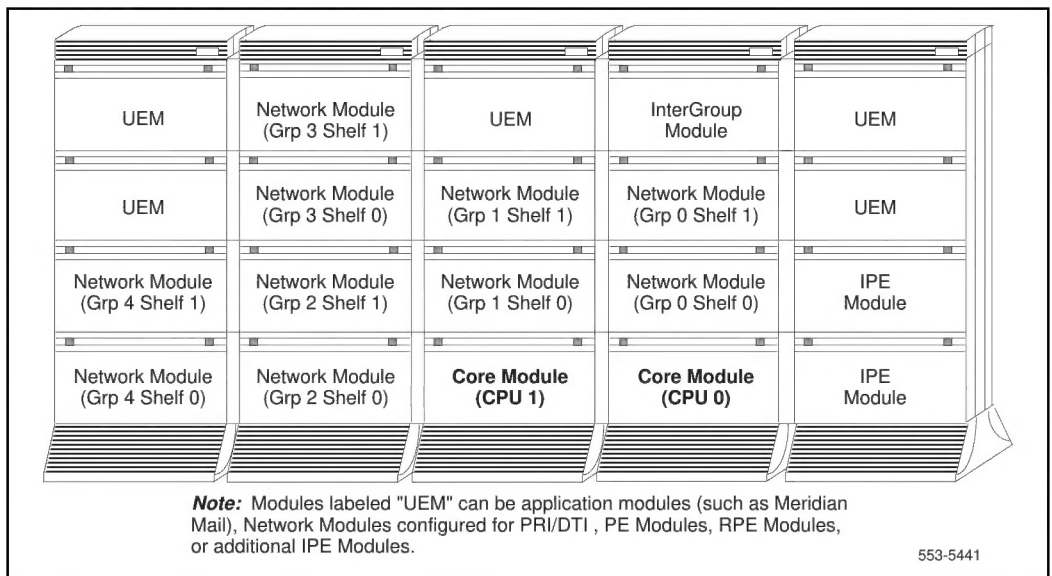
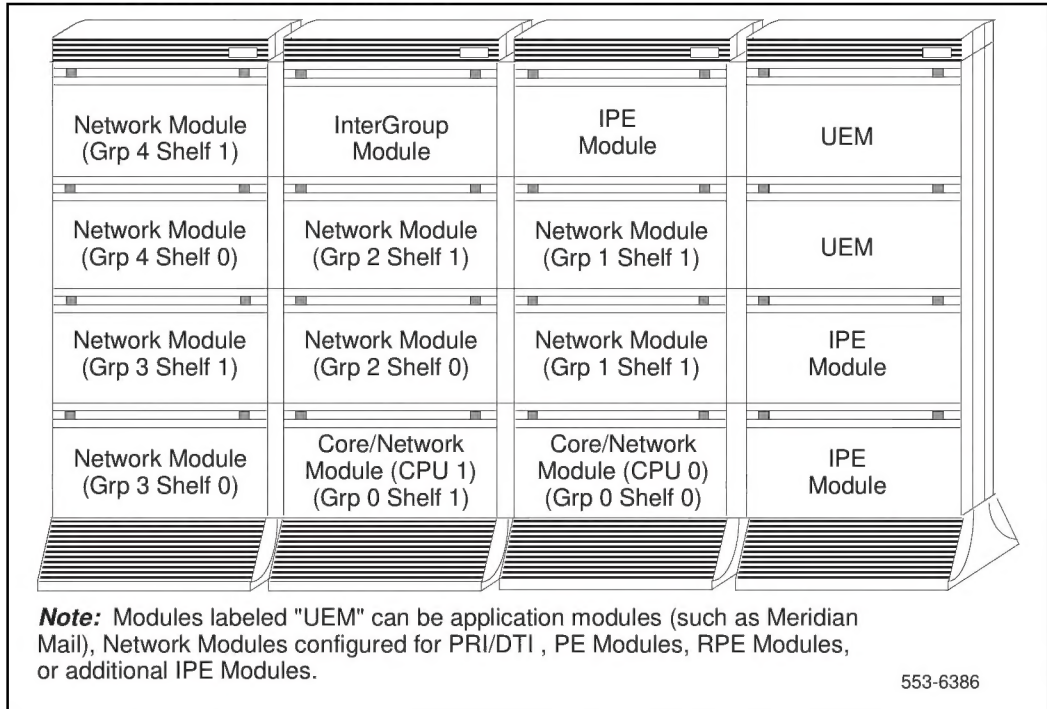


Figure 18 shows an option 81C system, Core Modules in option 81 (**Figure 17**) are replaced by Core/Network Modules. Option 81C also provides one network group (Group 0) by the two Core/Network Modules. This allows replacement of Network Modules for Group 0 with IPE Modules for lines expansion.

Figure 18
Option 81C with five network groups



I/O access

System options other than option 81

The system architecture assigns one address-mapped I/O space to read, write, and test I/O devices including:

- serial data ports on SDI, ESDI, DCHI, and MSDL cards
- network and superloop network cards
- TDS, conference, and multifrequency sender (MFS) network service cards
- DIGS and IGS cards
- peripheral signaling cards
- clock controller cards

In option 71, the I/O bus is extended to each network group shelf through a cable from a QPC215 SBE Card in a CPU Module to a QPC441 3PE Card in a Network Module.

System option 81

The system architecture assigns multiple address-mapped I/O spaces, one per network group, for accessing I/O devices. The I/O bus is extended to each network group through cables from secondary shrouds on the Core Module backplane to QPC441 3PE Cards in Network Modules. The backplane shrouds interface with the two ports on each NT6D65 CNI Card.

CNI configuration (options 51C, 61C, and 81C)

In the NT9D11 Core/Network module, port 0 is dedicated to group 0, and the CNI card must be installed in slot 12. This is because the option 61C is a single-group system and the option 51C is a half-group system.

In option 81C, the NT5D21 Core/Network Module supports up to three CNI cards in card slots 12, 13, and 14. In new systems the CNI card in slot 12 usually supports group 0, the CNI card in slot 13 supports groups 1 and 2, and the CNI card in slot 14 supports groups 3 and 4 for a total of five groups. In upgraded systems that may not be the case.

Note: Network groups configuration is flexible. Any CNI port may support any given network group, however, for ease of maintenance, associate network groups and CNI ports in a logical sequence. Refer to [Table 5](#) for a typical CNI port assignment and the associated network group. Port 0 of the CNI in slot 12 and the 3PE card are hard wired at the module's backplane.

The NT5D21 Core/Network Module is also used in options 51C and 61C with X11 release 21 and higher. Again, port 0 is dedicated to group 0, and the CNI card must be installed in slot 12. This is because the option 61C is a single group system and option 51C is a half-group system.

CNI configuration (option 81)

In the NT6D60 Core Module, port 0 on the NT6D65 CNI Card in slot 8 is preconfigured as “group 5.” This is not equivalent to a network switching group (groups 0–4). “Group 5” extends the interprocessor bus through the CNI card in slot 8 to the 3PE card in slot 7 in the interface section of the module.

There are two ports on each CNI card. However, if only one CNI card is equipped, only one network group is supported. This is because the CNI card must be installed in slot 8 and Port 0 is dedicated to “group 5.” Only Port 1 can support a network switching group. Therefore, to support two network groups, two CNI cards are required. To support three network groups, still only two CNI cards are required, because one port is available in slot 8 and two ports are available on the second CNI card.

In a typical configuration, there are three CNI cards for five network groups (see [Table 5](#)) in each Core and Core/Network Module.

Table 5
Typical CNI configurations (options 81 and 81C)

Option 81C CNI card slot / port	Option 81 CNI card slot / port	Network group supported
—	CNI 8 / Port 0	Core bus extender (preconfigured as “group 5”)
CNI 12/ Port 0	CNI 8 / Port 1	Group 0
CNI 12/ Port 1	CNI 9 / Port 0	Group 1
CNI 13/ Port 0	CNI 9 / Port 1	Group 2
CNI 13/ Port 1	CNI 10 / Port 0	Group 3
CNI 14 / Port 0	CNI 10 / Port 1	Group 4
Note: You do not have to configure both ports on a CNI card.		

Network configuration

Network switching cards digitally transmit voice and data signals. Network switching also requires service loops (such as conference and TDS loops), which provide call progress tones and outpulsing.

The two types of network cards available are:

- the NT8D04 Superloop Network Card which provides four loops per card grouped together in an entity called a superloop
- the QPC414 Network Card which provides two loops per card

On most Meridian 1 system options, network loops are organized into groups. A system is generally configured as one of the following:

- a half-group system which provides up to 16 loops
- a full-group system which provides up to 32 loops
- a multiple-group system which provides up to 160 loops

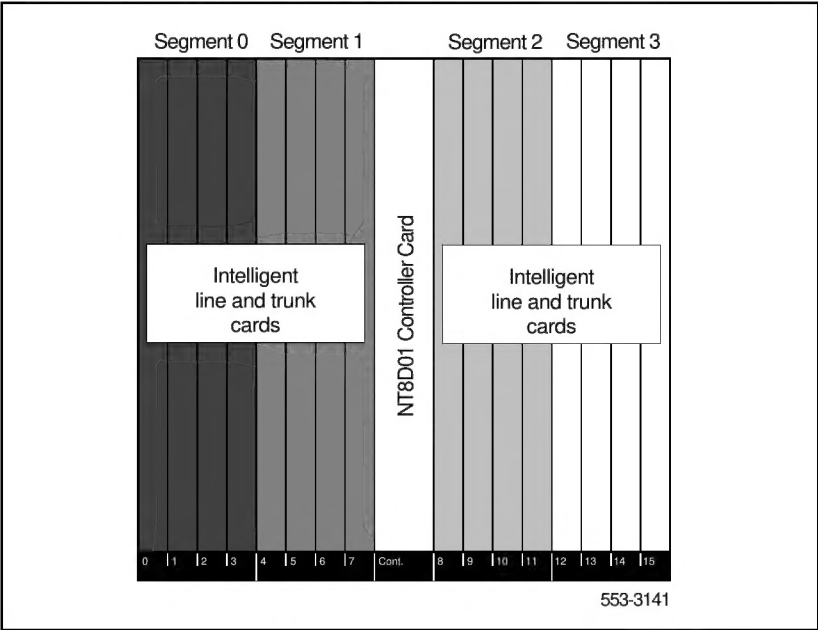
An additional switching stage is required for switching to be performed between groups in multiple-group configurations. This switching stage, an extension of the originating and terminating network loops, is provided by intergroup switch cards and the junction board in the InterGroup Module.

Superloop network configurations

By combining four network loops, the superloop network card makes 120 traffic timeslots available to IPE cards. The increased bandwidth and larger pool of timeslots provided by a superloop increases network traffic capacity for each 120-timeslot bundle by 25 percent (at a P0.1 grade of service).

The NT8D37 IPE Module is divided into segments of four card slots numbered 0–3 (see [Figure 19](#)). Segment 0 consists of slots 0–3, segment 1 consists of slots 4–7, segment 2 consists of slots 8–11, and segment 3 consists of slots 12–15. A superloop can be assigned from one to eight IPE segments.

Figure 19
Superloop segments in the IPE Module



A superloop is made up of NT8D04 Superloop Network Cards, NT8D01 Controller Cards, and from one to eight IPE segments. The NT8D01BC Controller-4 Card interfaces with up to four superloop network cards. The NT8D01BD Controller-2 Card interfaces with up to two superloop network cards.

The following superloop-to-segment configurations are supported:

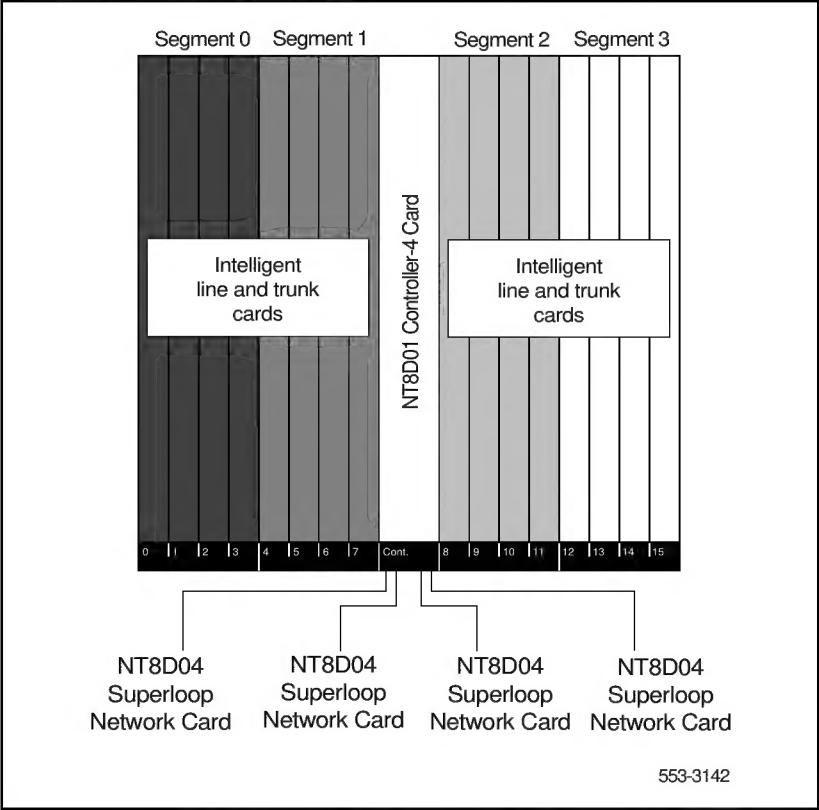
- one segment per superloop
- two segments per superloop
- four segments per superloop
- eight segments per superloop
- one segment per superloop/three segments per another superloop
- two segments per superloop/six segments per another superloop

One segment per superloop

A configuration of one segment per superloop requires four superloop network cards and one NT8D01 Controller-4 Card (see [Figure 20](#)).

If the segment is equipped with digital line cards that have all 16 voice and all 16 data terminal numbers (TNs) provisioned, this configuration provides a virtual nonblocking environment (120 traffic timeslots to 128 TNs).

Figure 20
One segment per superloop



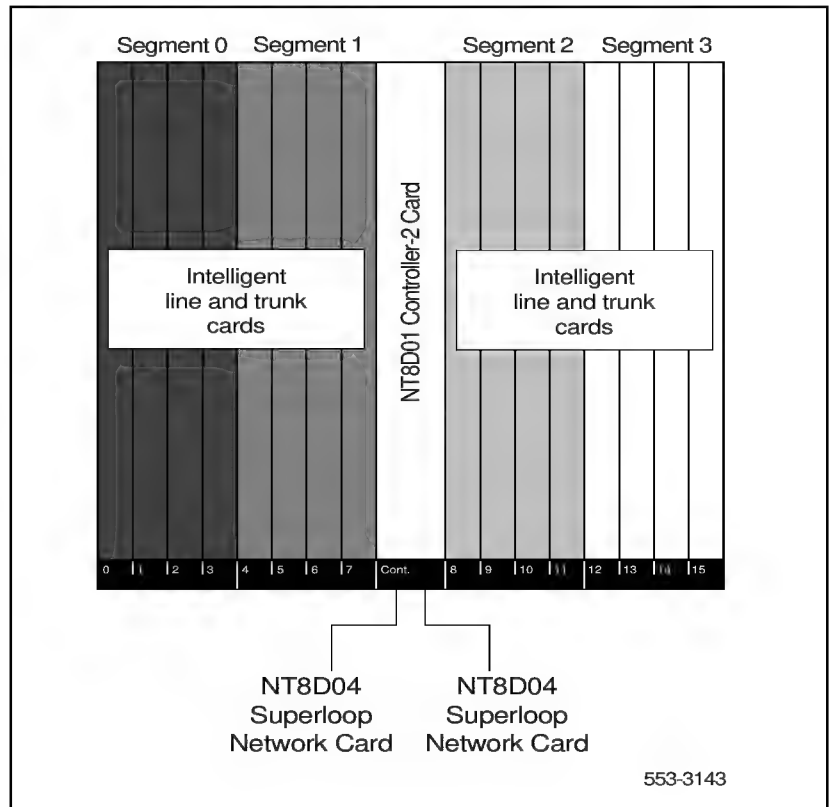
Two segments per superloop

A configuration of two segments per superloop requires two superloop network cards and one NT8D01 Controller-2 Card (see [Figure 21](#)).

If the segments are equipped with analog line cards and trunk cards, this configuration provides a virtual nonblocking environment (120 traffic timeslots to 32–128 TNs).

If half of the data TNs on digital line cards are enabled, this configuration still provides a low concentration of TNs to timeslots (120 traffic timeslots to 196 TNs) and a very low probability of blocking.

Figure 21
Two segments per superloop



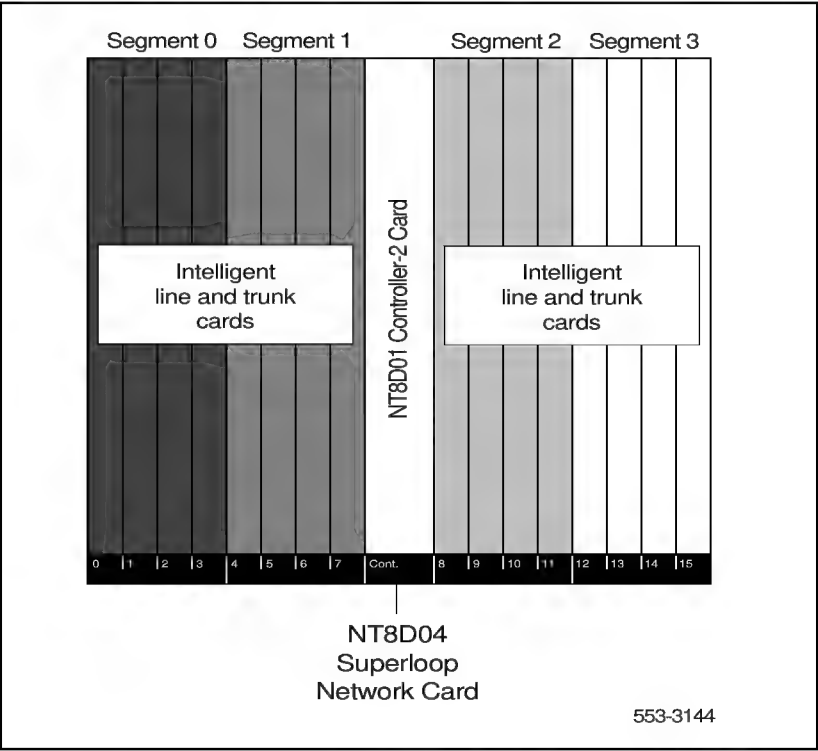
Four segments per superloop

A configuration of four segments per superloop requires one superloop network card and one NT8D01 Controller-2 Card (see [Figure 22](#)).

If the segments are equipped with analog line cards and trunk cards, this configuration provides a medium concentration environment (120 traffic timeslots to 64–256 TNs).

If half of the data TNs on digital line cards are enabled, this configuration provides a concentration of 120 traffic timeslots to 384 TNs.

Figure 22
Four segments per superloop



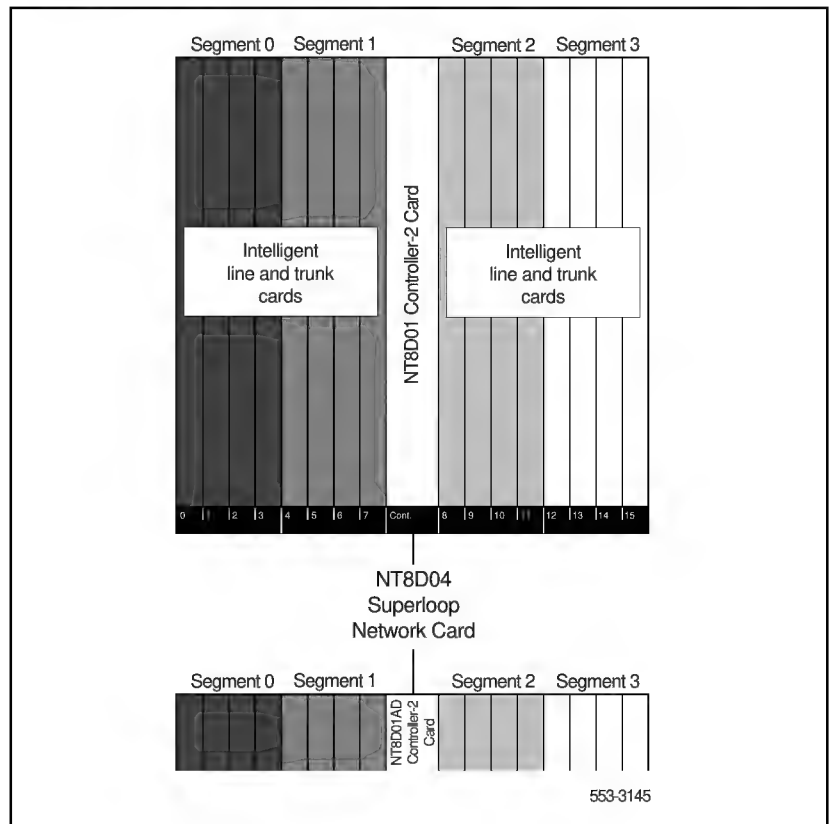
Eight segments per superloop

A configuration of eight segments per superloop requires one superloop network card and two NT8D01 Controller-2 Cards (see [Figure 23](#)).

If the segments are equipped with analog line cards and trunk cards, this configuration provides a high concentration environment (120 traffic timeslots to 128–512 TNs).

If half of the data TNs on digital line cards are enabled, this configuration provides a concentration of 120 traffic timeslots to 768 TNs.

Figure 23
Eight segments per superloop



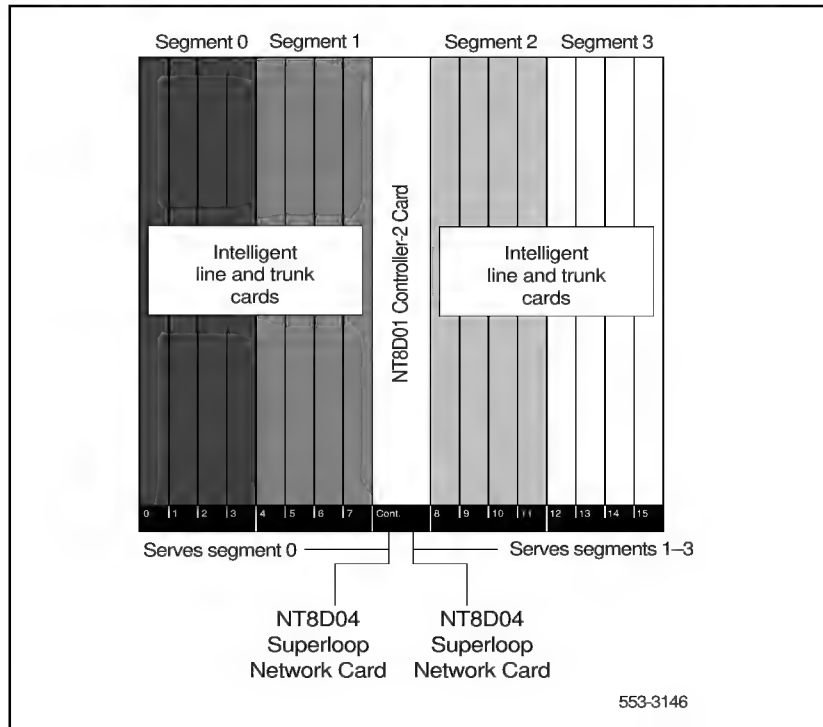
One segment per superloop/three segments per another superloop

A configuration of one segment per superloop/three segments per another superloop requires two superloop network cards and one NT8D01 Controller-2 Card (see [Figure 24](#)).

This configuration provides:

- a virtual nonblocking environment (120 traffic timeslots to 128 TNs) for the single segment served by the first superloop
- a medium concentration of TNs to timeslots for the three segments assigned to the additional superloop

Figure 24
One segment per superloop/three segments per superloop



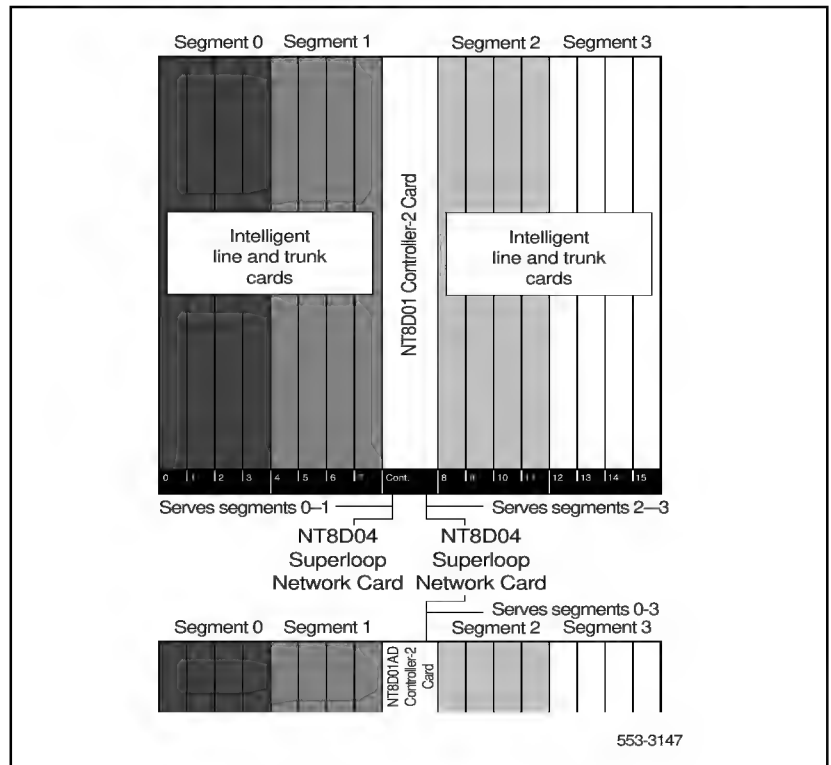
Two segments per superloop/six segments per another superloop

A configuration of two segments per superloop/six segments per another superloop requires two superloop network cards and two NT8D01 Controller-2 Cards (see [Figure 25](#)).

This configuration provides:

- a virtual nonblocking environment for the two segments served by the first superloop (or a very low concentration of TNs to timeslots if some data TNs are enabled)
- a medium concentration of TNs to timeslots for the six segments assigned to the additional superloop

Figure 25
Two segments per superloop/six segments per superloop



IPE configuration

As described in “Network configurations,” an IPE Module is divided into segments of four card slots that are assigned to superloops. A superloop combines four regular network loops to make 120 traffic timeslots available to the IPE cards. There can be from one to eight segments in a superloop, in a number of configurations. Each configuration is selected based on system traffic requirements and the specific IPE cards used.

Preferably, a superloop should be configured to serve an even number of segments. You should assign full traffic and IPE cards to one superloop before assigning the next superloop. However, there may be empty IPE slots associated with a superloop if the superloop is not assigned to exact multiples of eight cards. As the system grows, more IPE cards can be added to that superloop.

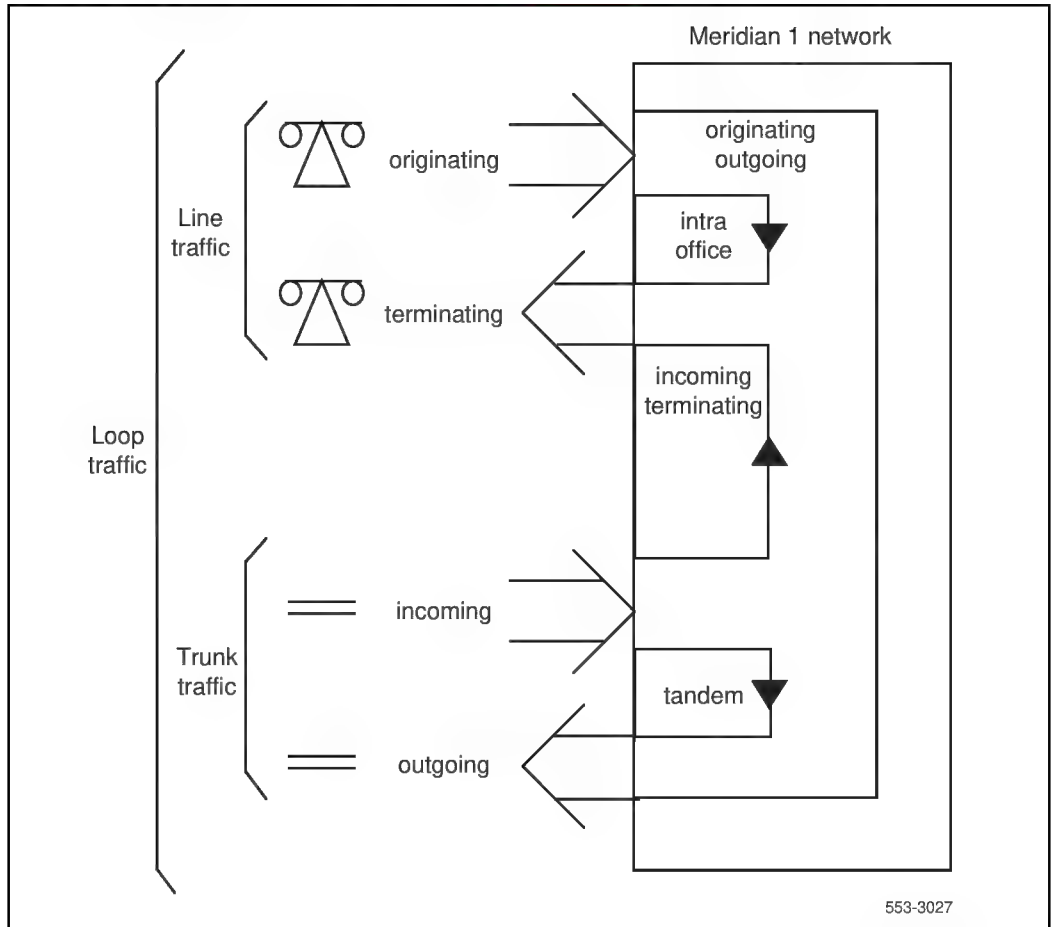
For traffic purposes in options 21A, 21, or 21E, the network/DTR card is typically assigned to serve 96 lines, 32 trunks, and 8 DTR ports (10 IPE cards total) even though it has higher traffic capacity.

The total number of ringing generators required in a system can be minimized by consolidating analog line cards in as few IPE Modules as possible. However, for traffic and reliability purposes, the analog line cards must not fill more than three-fourths of the IPE Module.

Traffic configuration

The traffic distribution when considering individual customer or system traffic is shown in [Figure 26](#).

Figure 26
Traffic distribution



Traffic definitions

The following list gives definitions for traffic terminology used in determining the provisioning requirements of a Meridian 1 system:

- CCS = Hundred call seconds is the unit in which amounts of telephone traffic are measured. One call that lasts for 100 seconds equals one CCS.
- Line CCS = Incoming terminating CCS + originating outgoing CCS + terminating intra-office CCS + originating intra-office CCS
- I/O = Intra-office traffic in CCS
- Intra-office Ratio (R) = Terminating intra-office CCS + originating intra-office CCS ÷ line traffic in CCS
- Loop CCS = Line CCS + incoming terminating + originating outgoing
or
= Line CCS x (2-R)
- Total line CCS = Total loop CCS ÷ (2-R)
- Total trunk CCS = Total line CCS x (1-R)
or
= Total loop CCS x (1-R) ÷ (2-R)
- Total intra-office capacity (terminating + originating) = Total loop CCS x R ÷ (2-R)
- Total I/O CCS = Total loop capacity x R ÷ (2-R)
- Network CCS = Total CCS handled by the switching network
or
= CCS offered to the network by stations, trunks, attendants, Digitone receivers, conference circuits, and special features
- InterGroup CCS = The measure of traffic flow between two network groups in systems with more than one network group

Network loop traffic

Typically, initial equipment is configured at an 85 percent utilization level to leave room for expansion. The traffic level per network loop depends on whether or not the peripheral equipment uses Digitone equipment:

- 3500 CCS is the capacity of a fully loaded superloop.
- 2975 CCS is 85 percent utilized; Digitone traffic is a part of the capacity.

Partitioning

The Meridian 1 can be configured as a partitioned or nonpartitioned system when it serves more than one customer.

A partitioned system dedicates each customer and the customer's associated lines and trunks to actual partitioned segments of the system in terms of loops and modules. Consoles and Digitone receivers are normally spread over all loops and modules in a partitioned system.

In a nonpartitioned system, all customers, trunks, lines, consoles, and Digitone receivers are spread over all loops and modules. A nonpartitioned system provides the following advantages:

- fewer traffic loops are required
- fewer peripheral equipment (IPE and PE) modules and cards are required
- system call-carrying capacity is more easily achieved and maintained
- customers are distributed evenly over the loops
- load balancing is more easily accomplished

Network loop assignment

When assigning the loop number in systems equipped with two Network Modules, distribute the load evenly across both modules. Record the loops used in Worksheet A.

Distribute the total number of IPE Modules over the total number of voice and data loops. Normally, one IPE Module is assigned to a superloop. However, one IPE Module can be assigned from one to as many as four superloops, depending on the concentration of terminal number-to-timeslot ratio.

Compute the number of network groups based on the total number of loops required (excluding conference/TDS loops). Use [Table 6](#) and the following equation to find the number of network groups required:

$$\text{Total number of loops} = (4 \times \text{the number of superloop network cards}) + (2 \times \text{the number of QPC414 Network Cards})$$

Table 6
Loop number assignment

Number of groups	Loop assignments
1	28
2	56
3	84
4	112
5	140

Peripheral equipment card distribution

Use Worksheet B to determine the total number of each type of IPE and PE card (line, trunk, DTR) for each IPE and PE Module.

Use Worksheets C and D to determine the number of multiple appearance groups (MAGs) assigned to each loop (use Worksheet E as an MAG record sheet). Distribute MAGs evenly over all the loops.

Do not assign MAGs that call each other frequently to the same loop; assign them to the same network group to reduce intergroup calls in multiple network group systems. If possible, avoid MAGs of more than ten.

Within a multiple network group system, assign users that call each other frequently to the same network group. Similarly, assign trunk groups that are used primarily by certain groups of users within the same network group as those users.

Card slot priority

Input messages from card slots 0 and 1 in each IPE Module (card slot 1 in each PE Module) are directed to a high-priority input buffer. The input messages from the remaining slots are directed to a low-priority input buffer. To minimize input buffer delay on signals from devices in high-priority card slots, the system processes the low-priority input buffer only when the high-priority buffer and 500-type telephone output buffers are empty. This mechanism is important only for the types of trunks that require critical timing.

Class-of-service priority

Selected telephones and trunks can be assigned a high-priority class of service that allows their requests for dial tone to be processed first. The fewer the telephones and trunks assigned as high priority, the better the service will be during heavy load conditions.

Trunks

The recommended card slot assignment for trunks is as follows:

- Always assign automatic inward and outward dial trunks to card slots 0 and 1.
- If possible, assign delay dial, wink start, and DTMF-type trunks to a high-priority card slot. Other types of trunks can be assigned to high-priority card slots to avoid glare, but can also be assigned to low-priority card slots (2 through 10).
- To minimize the number of high-priority input messages during pulsing, do not assign trunks using 10 or 20 pps (incoming) to a high-priority card slot unless necessary.

Attendant consoles

Do not assign attendant consoles to a high priority card slot. Too many high priority messages from attendant consoles assigned to these card slots can result in delays in output messages to attendant consoles, telephones, and trunks. Always assign attendant consoles to card slots 2 through 10. Do not assign a large number of attendant consoles to the same network loop since buffer overflow may result.

500/2500 telephones

The 500/2500 telephones can be assigned to any card slot. However, assigning a 500/2500 telephone to a high-priority card slot can cause input messages to delay output buffer processing during pulsing.

Assigning card slots

Use Worksheet F to assign cards to slots in all peripheral equipment modules. Calculate the average load after all cards of a particular type have been assigned. Total the load and keep a running total. This method prevents the need to interchange cards at the end of the process because of load imbalance. Assign cards in the order listed below.

- 1 Assign cards requiring a high priority slot.

Note: For PE Modules, card slot 1 is reserved for high-priority signaling. For IPE Modules, both card slots 0 and 1 are reserved for high-priority signaling.

- 2 Assign cards for high-usage trunks, such as central office (CO) trunks.
- 3 Assign cards for low-usage trunks, such as paging and dictation.
- 4 Assign cards for attendant consoles.
- 5 Assign DTR cards.
- 6 Assign cards for telephones associated with multiple appearance groups.
- 7 Assign remaining cards. On a system that has a high density of Digitone telephones, assign the least number of 500-telephone line cards to loops that have DTRs assigned.

Note: Distribute loops and conference/TDS cards evenly across network modules and groups.

- 8 Calculate the total load per module.
- 9 Calculate the total load per loop.
- 10 If required, rearrange card assignments to balance the load.

Assigning terminal numbers

Once the cards are assigned, the individual units on each card can be assigned. Use Worksheet G to record the terminal number (TN) assignments. TN 0000 cannot be used on superloop 0. Therefore, assign loop 0 to a QPC414 Network Card.

Ongoing configuration

Ongoing assignment plan

Use the initial assignment records to complete an assignment plan for each equipped network loop in the system (see Worksheet H). Assignments for future trunks, Multiple Appearance Group (MAG) stations, consoles, and DTR requirements can be developed for each loop according to this profile.

Cutover study

Once the system is placed in service, a cutover study should be performed. The results of this study are used to update the loop profiles and create a new assignment plan. Ongoing assignments must follow the new assignment plan until the first customer busy-season trunking study. At that time, loop threshold measurements are set so that at least one of the predominant busy hours would produce a CCS load output.

Threshold study

From the threshold study printout, the loop profile must be updated and a new assignment plan developed. At this time, it is advisable to estimate the system capacity for growth. If the growth capacity is sufficient to last beyond the next annual threshold study, assignments can continue in accordance with the assignment plan. If the growth capacity is insufficient, plans must be made to establish a tentative date when new equipment (loops or modules) must be ordered and installed. This date is generally controlled by physical capacity and tracked by total working physical terminations.

Equipment relief

When additional equipment is installed, assignments should be concentrated on the new loop or modules until the first threshold study. At that time, the loop profile is updated and a new loading plan is developed. Any time a loop exceeds 560 CCS (based on an 85 percent traffic level), that loop must be suspended from future assignments. If a loop encounters service problems, it must be suspended and sufficient load removed to reduce service to an acceptable level.

Assignment records

The following printouts are available from the system and should be used in addition to worksheets to assist in maintaining assignment records:

- list of trunk route members
- list of TN blocks
- list of unused card positions
- list of unused units
- directory number (DN) to TN matrix

Refer to *X11 features and services* (553-3001-305) for information on obtaining and manipulating data in the system.

